



IIT MADRAS

Indian Institute of Technology Madras

Technology Transfer Office
TTO - IPM Cell



Industrial Consultancy & Sponsored Research (IC&SR)

A CASTING METHOD FOR PRODUCING HIGH-PERFORMANCE MAGNESIUM ALLOY

IITM Technology Available for Licensing

PROBLEM STATEMENT

- **Magnesium alloys**, made from magnesium and other alloying metals, are used in lightweight applications.
- **Casting processes** are common for these alloys, but they face challenges like dendrite formation, **microporosity**, **hot tears**, **non-homogenized microstructure**, and poor mechanical properties.
- **Various methods** have been explored to create **defect-free, high-strength AZ91 alloys**.
- The **current invention overcomes these issues**, resulting in a **cast magnesium alloy with a homogenized microstructure and improved mechanical properties**.

TECHNOLOGY CATEGORY / MARKET

Technology: Casting Method For Producing High-performance Magnesium Alloy

Category: Advance Material & Manufacturing

Industry: Manufacturing / Chemical

Application: Casting of magnesium alloy

Market: The global market size is **USD 2545.2 million in 2024**. It will expand at a compound annual growth rate (CAGR) of **9.00% from 2024 to 2031**.

INTELLECTUAL PROPERTY

IITM IDF Ref. 2778

Patent No: IN 550671

TRL (Technology Readiness Level)

TRL-4,
Experimentally validated in Lab;

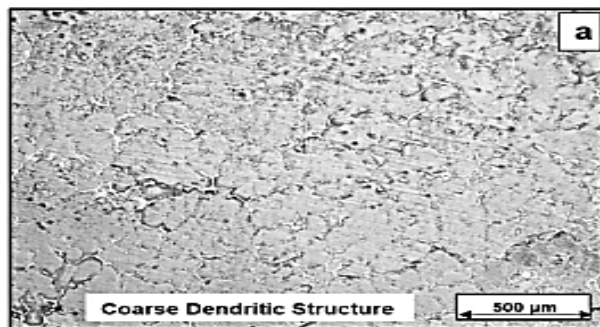
Research Lab

Prof. Sushanta Kumar Panigrahi,
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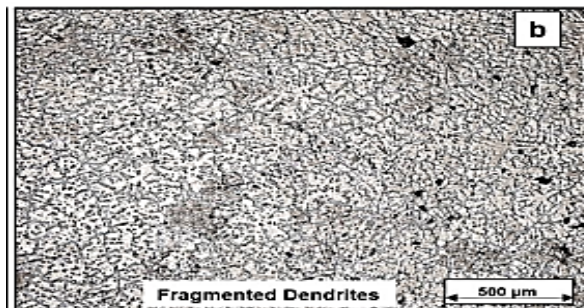
TECHNOLOGY

- 1 • A method of casting a magnesium alloy
- 2 • Melting the magnesium alloy to obtain an alloy melt
- 3 • Subjecting the alloy melt obtained in step a) to horizontal and vertical agitation motion
- 4 • Introducing inert gas pockets when the alloy melt temperature reaches its melting point and temperature range is 580-585 °C
- 5 • The gas pockets are introduced at a discharge rate of - 6-8 l/min till a semi solid temperature range is reached with agitation in horizontal and vertical direction
- 6 • The semi solid Cooling the alloy melt with gas pockets from step c) to yield a cast magnesium alloy.

a. Conventional Cast



b. Cast made by method encompass



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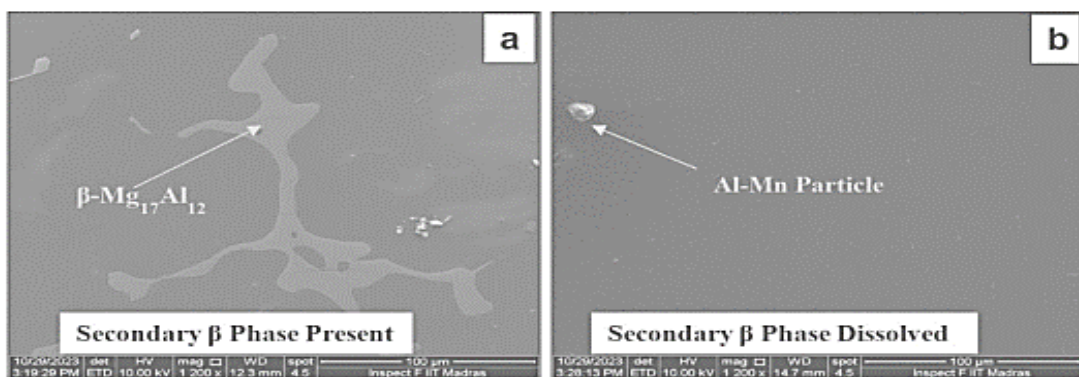
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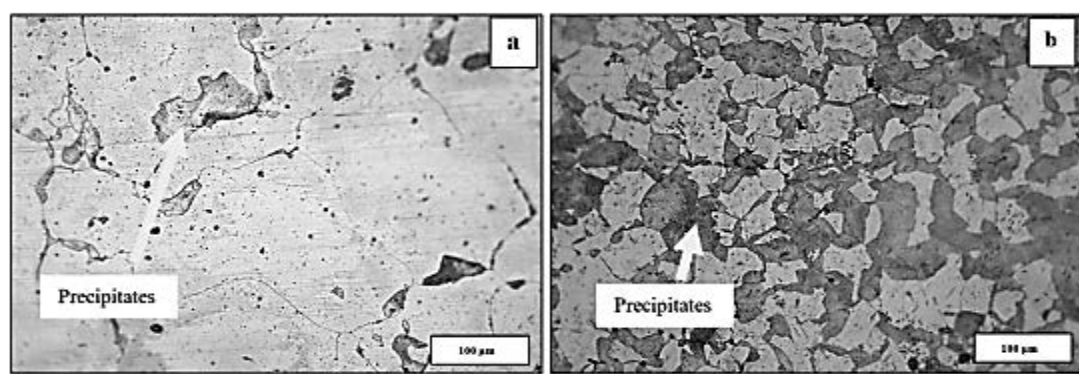
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SEM Images of cast after 12 hours of Solution Treatment
a) Conventional Cast
b) Cast made by method encompassed



Optical Images of Peak Aged
a) Conventional Cast
b) Cast made by method encompassed

Key Features / Value Proposition

• Magnesium Alloy Melting Overview

- Melting magnesium alloy in blocks.
- No reinforcement, foreign particles, rare earth elements.
- Melting at 700-720°C range.

• Casting Magnesium Alloy:

- Composed of 8-10% aluminum.
- Containing 0.5-2% zinc.

• Gas Pocket Maintenance

- Maintains 25-530 μm diameter gas pockets.
- Agitating melt done by impeller at 200-250 RPM.

• Cast Magnesium Alloy Strength

- 220-280 Mpa, 4-8% ductility, 80HV.

• Inert gas:

- Argon

• Melted Alloy and Gas Pockets Maintenance

- Surface tension between alloy and gas pockets: 505-510 N/m.
- Impeller cavities: 1-3mm in diameter.

Cast magnesium alloy subjected to solution treatment and optional aging treatment.

- Solution treatment: Heating the alloy to 400-500°C for 10-14 hours.
- Aging treatment: Heating the metal to 170-190°C for 18-24 hours.

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